

Labs researchers observe molecular shuttling that mimics cellular behavior

Recurring reorganizations on man-made cell membranes may evolve into first tools for nanoconstruction

By John German

Labs researchers recently created and then examined molecular movements that could evolve into some of the first useful tools at future nanoconstruction sites, where proteins might be shuttled from place to place in tiny chemical wheelbarrows or built upon molecular scaffolding.

Using improved observational methods, the Sandia team watched as huddled receptor — or grabber — molecules on a man-made cell membrane rapidly dispersed across the membrane when they latched onto free-floating ligands (chemical particles), then rehuddled when the ligands were removed.

The behavior mimics biological reactions at the cell level, such as immune system response to viral particles, says Darryl Sasaki of Biomolecular Materials & Interfaces Dept. 1140. The work is based on previous research at Sandia to create metal-detecting sensors based on chemical recognition events (www.sandia.gov/media/metal.htm).

The team's observations are published as the cover story in the April 30 issue of the biweekly chemical and biophysics journal *Langmuir*, and work on a related system recently appeared in *Biophysical Journal* (November 2001).

For the experiment, the researchers created an artificial cell membrane made of "phospholipid bilayers" — rows of long molecules that, like empty pop bottles bobbing on water, self-organize into an orderly heads-up/tails-down formation.

They implanted this flat lipid film with specialized lipids carrying tall receptor headgroups — pincher- or lasso-shaped structures that chemically grab onto free-floating ligands. (See "Receptors team up to signal cellular response" on page 4.)

Then they watched as the receptors reacted to the addition of metal ions, not only for insights into cellular behavior but also for possible nanoscience advances such insights might offer.

At rest in solution the receptor-lipids pooled into aggregate zones between islands of receptor-less lipids.



TRACKING RECEPTORS — Sandia postdoc Julie Last (1140) uses an atomic force microscope to image the travels of receptor-lipids on an artificial cell membrane. (Photo by Randy Montoya)

But when metal ions (lead or copper) were added, the headgroups latched onto the ions, and ZIP!, the receptor-lipids dispersed evenly across the mem-

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Tungsten photonic lattice developed at Sandia changes heat to light

More efficient light sources, photovoltaics may be possible

By Neal Singer

Tungsten-filament bulbs — the most widely used light source in the world — are infamous for generating more heat than light.

That is, they radiate more energy in the infrared than in the visible spectrum.

Now a microscopic tungsten lattice — in effect, a tungsten filament fabricated with an internal crystalline pattern — developed at Sandia has been shown to have the potential to transmute the majority of this wasted infrared energy (commonly called heat) into the frequencies of visible light.

This would raise the efficiency of an incandescent electric bulb from five percent to greater than 60 percent and greatly reduce the world's most vexing power problem — excess electrical generating capacity and costs to homeowners caused by inefficient lighting.

The advance — which shifts emphasis from a photonic lattice's ability to guide light to its capability of stopping other frequencies from passing through it — also opens the possibility of increased efficiencies in thermal photovoltaic applications (TPV). Using a tungsten lattice as an emitter at

desirable frequencies, model calculations showed that the TPV conversion efficiency reached 51 percent compared with 12.6 percent with a blackbody emitter.

The advance, achieved at Sandia by Shawn Lin (1746) and Jim Fleming (1749), is reported in the May 2 *Nature*.

The imaginative work seems logical in retrospect, though the theory for the effect — re-partitioning energy between heat and visible light — remains unexplained. "It's not theoretically predicted," says Jim. "Possible explanations may involve the variation in the speed of light as it propagates through such structures."

The achievement was accomplished by an extension of well-known MEMS (microelectromechanical systems) technologies that themselves have been derived from mature semiconductor technologies. As a result, fabrication of such devices could be cheap and easy.

The most common use postulated for photonic lattices was based on their capability to transmit beams of light at selected frequencies and bend their paths without losing any energy.

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PRACTICE BURN — Emergency personnel and others from Sandia, Kirtland Air Force Base, and DOE emergency exercise April 17. The scenario was a fire in a Sandia building near Gate 10 on the south side of Technical Area 1. See more exercise pictures and a story on the practice emergency on page 6. (Photo by Randy Montoya)

World's arms control experts share views with peers during conference

By John German

It's been an interesting year for arms control negotiators and policy makers: US-Russian relations have evolved, nuclear proliferation fears have increased, US missile defense plans have matured, and much of the world has backed the US offensive against terrorism.

Some 230 ambassadors, policy makers, academicians, and other experts representing 35 countries gathered in Albuquerque April 18-20 to discuss these issues and others at the 12th Annual International Arms Control Conference, themed "Implications of 9/11 on National Security and

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What's What

Last time's short take on numbers brought a couple of responses to the 41 and 43 question. The answer is George H.W. Bush and George W. Bush — the 41st and 43rd presidents, who have baseball hats with those numbers. They are the first father-and-son presidents since John Quincy Adams (1825-29) followed his father, John Adams (1797-1801), to the White House. The Adamses and the Bushes are the only two father-son presidents in the country's history. The first President Bush even referred to the second one a few times right after the election as "my boy, Quincy."

* * *

On the matter of numbers, Larry Greher (11200) wants to know why TV channels start with 2; why not 1? And he has a suggestion for that empty (available?) slot on the TV "dial" — get the FCC to assign it as the Sandia Science Education channel nationwide. HmMMM. . .

* * *

Trends. Remember the note about Bettas a couple of columns back? . . . about the proliferation of the little fish floating serenely in their little water worlds on desks all across the campus? Well, the not-to-be-named suggestor of that blurb apparently could stand only so much serenity: She adopted her Bettas out. Maybe Bettas are like people in Andy Warhol's sense of the world, and they've now had their 15 minutes of fame.

* * *

Jeff Foster (9231) noticed a notice about a Diversity Cinema session called "Straight Talking: The Art of Assertiveness" in a recent edition of *Sandia Daily News* and sent the following:

"I took a class like this some months ago, but unfortunately it was just a week after a Sensitivity Seminar and the two cancelled each other out!! Just thought you might like to know What's What."

* * *

Tomorrow's the first Saturday in May, and even if you never twaddled your toes in the bluegrass, everybody's a Kentuckian on Kentucky Derby Day. It's sorta like St. Patrick's Day, when everybody's Irish. It's a day for mint juleps and ham biscuits — and burgoo (more on that another time), if you can make or find it — and wide-brimmed ladies' hats and fast-talking backstretch touts and the twin spires of Churchill Downs. And that mournful song, *My Old Kentucky Home*.

New York newspaper columnist and humorist Irvin S. Cobb — a Kentucky native known as the Sage of Paducah — once said of the spectacle, "Until you've been to the Kentucky Derby, you ain't never been nowhere and you ain't never seen nothin'." On another occasion he took a satisfied sip from his julep and declared: "Who has not tasted one has lived in vain."

Others mumble about cough syrup and say they'd be glad to live in vain if that would save them from drinking one.

And in an essay for the *Louisville Courier-Journal* the day after the 1956 Derby, John Steinbeck wrote, "This Kentucky Derby, whatever it is — a race, an emotion, a turbulence, an explosion — is one of the most beautiful and violent and satisfying things I have ever experienced." Needles won that race.

— Howard Kercheval (844-7842, MS 0165, hckerch@sandia.gov)

'Labs Accomplishments' wins praise from national newsletter

This 'Murphy's law' works for Sandia

A prickly but respected newsletter known for skewering corporate buzzwords — as well as company publications that express only management views — has devoted an entire page in its April 22 issue to praising the "Labs Accomplishments" yearly insert in the *Sandia Lab News*.

"The succinct capsule format of the 16-page special issue

lends itself to briefly recognizing work that is extremely complicated," rhapsodizes the *Ragan Report* article entitled, "Sandia makes employees feel good with annual 'accomplishments' pub."

The Accomplishments section, first published in 1981, depends on the efforts of tech staff members who propose candidate entries and representatives in the VPs' offices who screen and select them.

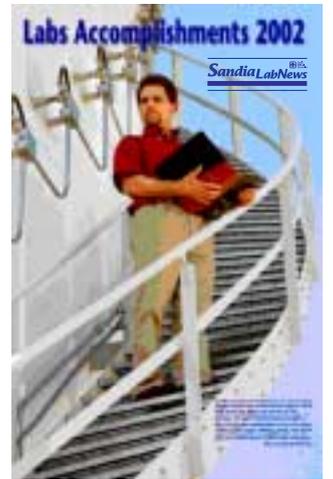
The section has been edited start-to-finish for the past seven years by the *Lab News*' Bill Murphy (12640). Murphy's only law for research contributors and administrators asked to describe their own work is to do it in 85 words or less.

"It's intentionally not an overly slick, overly rewritten supplement," says Bill. "I like to let the voices of the researchers and others who do the actual work come through as much as possible."

The purpose of the section, says *Lab News* editor Ken Frazier (12640), "is to recognize, in succinct form, important work of all types at Sandia."

This year for the first time the Labs Accomplishments was published as a separate special issue of the *Lab News*, dated February 2002.

—Neal Singer



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Recent Patents

Steven Gianoulakis (former Sandian in 9117): Crystal Growth and Annealing for Minimized Residual Stress.

Barrett Potter, Jr. (1846) and Kelly Potter (1118): 3-D Photo-Patterning of Refractive Index Structures in Photosensitive Thin Film Materials.

Walter Zubrzycki, Allen Vawter (both 1742), and Andrew Allerman (1126): Embedded High-Contrast Distributed Grating Structure.

Retiree deaths

David B. Holt (age 65) Feb. 18
Eulalio P. Trujillo (82) Feb. 19
Augustin Pohl (93) Feb. 22

Question for employees:

Does doing visible work buy you anything?

"How do you believe your career at Sandia is affected, either positively or negatively, based on the visibility of the programs/technologies on which you work?"

That's the question being posed for response on "Your Thoughts, Please" through May 17. To submit a response, go to the Web site at the News-Center, <http://www-irn.sandia.gov/newscenter/news-frames.html>, and follow the directions or simply submit an e-mail answer to thoughts@sandia.gov. Submissions with either name attached or "name withheld by request" are fine.

AP honors energy radio documentary by Sandia retiree Howard Stephens

The four-show radio documentary "Running on Empty: America's Energy Crisis" took second-place honors in the New Mexico Associated Press Broadcasters awards competition in the category of radio documentaries. The Associated Press Broadcasters award, which recognizes achievement in reporting, was presented to National Public Radio affiliate Albuquerque's KUNM FM 89.9 and "Running on Empty" producers at its recent annual awards dinner.

Sandians Margie Tatro (6200), Tom Blejwas (6400), and UNM Professor Timothy Moy, a Sandia consultant (in Org. 16000), are among the energy experts featured in the documentary's in-depth examination of America's energy landscape. The program was produced by retired Sandian Howard Stephens; his wife, writer Virginia Stephens; and local media producer Jim Cochran.

Because of the national attention received by "Running on Empty," and the continued uncertainty of America's energy future, the producers have been asked to update and rebroadcast this award-winning radio documentary. The updated version is slated for broadcast on KUNM in June. It will also be redistributed to public radio stations nationwide during the summer.

"Running on Empty" is a project of Vision Trust, a New Mexico-based nonprofit organization.

Sandia-industry team powers a mining locomotive with pollution-free hydrogen

First-ever fuel-cell-powered locomotive pulls its load in tests at Reno

By Nancy Garcia

A potentially revolutionary locomotive rolled into the hydrogen-powered age recently on a test track in Reno, Nev., energized by environmentally friendly fuel cells that a Sandia/California team added to the mining vehicle.

"This is the first ever built in the world, and we learned a lot," says Jennifer Chan (8731), lead engineer and project lead since October.

"It's a major step." The advance was welcomed by the mining industry, which bestowed a "best of show" award on the locomotive at the Canada Mining Expo last May.

In Reno, the four-ton commercial vehicle, originally designed to operate on battery packs, showed its prowess by pulling a 500-pound section of loose track at a Burlington Northern (Kappes, Cassidy & Associates) warehouse sidetrack in Reno. The fuel cells supplied 8.5 kW power as the locomotive glided quietly along the 400-foot test track.

Fuel cells combine hydrogen and oxygen to create water, releasing energy but virtually no pollution. Although they are not yet mass-produced, fuel cells are routinely used in such cost-insensitive applications as powering the space shuttle.

In looking for a transportation market "point of entry," the Fuel Cell Institute, which proposed the project, selected mining vehicles as a potential economically viable initial application.

Nearly all mines employ diesel power, requir-

"It's a major, major step forward. If we handed out knighthoods, one would be involved."



GETTING SETTLED — The crew positioned the mining locomotive, originally designed to run on batteries, on the sidetrack for test operation under hydrogen power. The test was conducted at Burlington Northern's yards in Reno, Nev.

generation creates pollution.

The two fuel cell stacks, by the Milan-based company Nuvera, each have a maximum output of 7 kW. Sandia designed and built a metal hydride storage system to safely store the volatile hydrogen, absorbed onto a powdered metal alloy known as a "hydride bed" at the relatively low pressure of 150 psi. The bed can hold almost all the contents of six cylinders of hydrogen, which is normally compressed in the canisters to 2,000 psi.

The bed capacity lets the vehicle operate for a full eight-hour shift before requiring refueling above ground (which may take about an hour).

Sandia developed the "balance of plant" as well as the power plant for the locomotive. The balance of plant includes the water-cooling of the fuel cell, heating of the hydride bed (the heat from the fuel cell is used to heat the hydride bed for optimal operation), balance of air and hydrogen supply to the fuel cells, and the controls and safety systems. The power plant includes the integration of the hydride beds and balance of plant with the locomotive.

Following the above-ground safety assessment, the locomotive will be

trucked in a temperature-controlled shipping container to Canada, where it will be compared to electric-powered locomotives at Val d'Or, a former metal mine maintained as an underground experimental mine.

"It's a major, major step forward," says mining engineer Harry Bursey of project partner Warren Equipment. "If we handed out knighthoods, one would be involved." He anticipates the project will be a legacy to upcoming mine workers, such as his son, a geologic engineer in tunneling.

"Diesel exhaust fumes are not only uncomfortable," he explains, "they can be bad on health in the confined atmosphere of an under-

Sandia California News

ground mine, and in tunneling as well. The application of fuel cells to replacing diesel engines is absolutely vital. It's a very forward-looking solution."

The project's success could pave the way for production of some 150 hydrogen-powered mine vehicles per year.

The next aspect of the project, to begin this summer, is demonstration of a hydrogen-powered 100kW front-loader for mine use.

So far, nine Sandians have worked for two years on the project with the Fuel Cell Propulsion Institute, Vehicle Projects, the University of Nevada, Warren Equipment, Hatch consultants, the Canadian regulatory agency, MSHA, and Placer Dome and KC&A mining companies.

Besides Jennifer, team members include Ray Baldonado (8214), Ken Black (8120), Don Meeker (8724), Dan Morse (8723), Systems Engineering Dept. 8731 Manager Bill Repogle, Ken Stewart (8730), George Thomas (Sandia/California retiree/consultant), Dan Trujillo (8120), and Mark Zimmerman (8731). Jay Keller (8362) coordinates funding through DOE's Office of Power Technology.



UNDER CONTROL — During the above-ground tests, a laptop computer captured some data from the control system.

ing expensive ventilation. Replacing diesel with hydrogen-powered vehicles would save an estimated 30-40 percent in ventilation costs, easily offsetting the cost of the fuel cells. "Those costs alone make this very viable economically," says David Barnes, project manager for prime contractor Vehicle Projects.

There might also be benefits to switching electric- and battery-powered mine vehicles for hydrogen-fueled ones, Barnes says. Batteries have to be charged overnight and switched out, while electric vehicles are tethered by long "extension cords" that present a hazard if run over. And if the electricity comes from coal-fired plants, its



MOVING FORWARD — The mining locomotive ran on rails for the first time under hydrogen-fuel-cell power at a sidetrack in Reno.

Molecular shuttling

(Continued from page 1)

brane surface as their newly acquired electrostatic charges caused them to become mutually repulsed.

When the metal ions were removed, the wayward receptor-lipids retraced their steps and regrouped into the same aggregated pools.

"When they bind to the metal, they each race away from their nearest neighbor," says Darryl. "When the ions are removed, they race back to where they were."

The process was performed repeatedly on the same membranes with the same result — reversible reorganization.

Darryl believes the trails the receptor-lipids follow and the pools they return to correspond, quite literally, to the paths of least resistance on the membrane's surface — areas where the lipid film is more liquid than solid, allowing the traveling lipids to flow like water.

Tracking tiny travelers

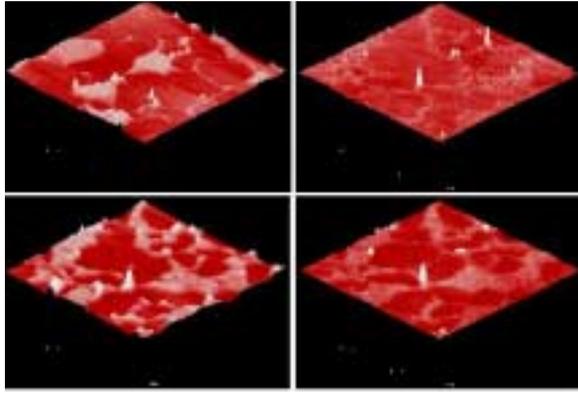
Although producing such chemical recognition events on an artificial membrane is not an achievement in itself, examining them with such fidelity is, says Darryl. The Sandia team used novel microscopy and spectroscopic techniques to make the first documented observations of receptor-lipids repeatedly stepping out and then returning home.

Fluorescent pyrene tags were attached to the tails of the receptor-lipids to aid in tracking their travels on the membrane. When the receptors were aggregated — as seen using fluorescence spectroscopy — the huddles appeared bright. When the receptors were dispersed, their fluorescent signals were dim.

In addition, the team used an atomic force microscope to map the surface texture, or topography, of the lipid membrane, identifying locations of the tall receptor headgroups that towered 8 angstroms (about one billionth of a meter) higher than the tops of the membrane lipids.

These observations provided unprecedented clarity about the locations of the receptors in both the dispersed and aggregated states, says Darryl.

"We've been able to characterize films as they



TINY TRAVELERS — A series of atomic force microscope topographic images shows receptor-lipids (white areas) in an initial aggregated state (top left), dispersed following the addition of lead ions (top right), re-aggregated after the lead was removed (bottom left), and dispersed again following a second dose of lead ions (bottom right). An 8-angstrom height difference allows the receptor-bearing lipids to be readily distinguished from the shorter molecules that make up the phospholipid film.

change their properties at both the macroscale and nanoscale," he says. "It's the first time such a dynamic molecular system has been imaged this way."

As a result of the team's work, he says, scientists will have a better understanding of chemical recognition on cell-like membrane systems.

Perhaps more tantalizing, he says, are the possibilities the new understandings might bring to the nanotechnology community's growing toolbox.

"The idea of using chemical recognition to form specific structures in the membrane may be a potent tool to aid in the development of controllable nanoscale architectures," says Darryl.

If receptor headgroups propelled to and fro by chemical recognition events can be enlisted to hoist molecules and proteins and deposit them in planned locations, he says, designing and building nanosized structures, such as single-molecule-wide wires, might be possible.

And the receptor-lipids' tendencies to follow preferred pathways offer promise for engineered construction of nano-railroad tracks along which a variety of molecular cargo could be recurrently moved, perhaps aboard motor-protein railcars,

he says.

If nano-engineers can control these routes, two- or three-dimensional lipid scaffolds might be designed upon which proteins could be laid down to build nanoscale electronic or photonic circuits.

Nano-switching structures might be designed that self-construct and self-destruct based on chemical recognition events.

In addition, researchers have long sought to build cell-like pods that, when injected into a person's blood stream, would recognize diseased cells and release a drug to destroy those cells selectively. Such a capability could revolutionize medical approaches to treating a variety of illnesses.

"By harnessing even a fraction of the capability of cellular membrane recognition systems, it may be possible to build unique sensor systems that are not only rapid and specific in response but also are innately biocompatible," adds Darryl.

Sandia team members include Tina Waggoner, Julie Last (both 1140), and Todd Alam (1811).

Receptors team up to signal cellular response

Each receptor headgroup is like a catcher's mitt held high above the cell's surface but shaped to catch only portions of chemical or biological particles that fit snugly into its glove.

The hundreds of mitts on a typical cell's surface form small teams to collectively receive any of the millions of possible threats or food sources the cell might encounter.

This patterned reorganization, scientists believe, initiates chemical recognition and cellular signaling, alert mechanisms that prepare the cell to feast or fight.

Cellular processes such as immune system response, endocytosis, cell division, and cell adhesion are initiated by similar cellular encoding.

"What receptors are brought together and how they are organized tell the cell what to do," says Darryl Sasaki (1140).

Tungsten

(Continued from page 1)

The structures, most often made out of silicon, consist of tiny bars fabricated to sit astride each other somewhat like Lincoln Logs at pre-set distances and angles that form in effect an artificial crystal. Spacing of the bars allows passage of only certain wavelengths; other wavelengths cannot pass through. Desirable wavelengths not only transmit but also can be changed in direction by creating defects in the artificial crystal that cause the light to follow the defect along like a car passing through a curving tunnel. This meant photonic crystals had potential in optical communications, in which light beams currently carrying telephone messages and data must be converted to electrons — an expensive process — to change direction.

That was where published conceptions and economic activity seemed to have stopped.

Meltdown? Apparently not

A further question considered by Shawn and Jim, with assistance from colleagues Ihab El-Kady, Rana Biswas, and Kai-Ming Ho at Ames Laboratories in Iowa, was what happens to other energies that enter the interior of a three-dimensional crystal. If the crystal were built of tungsten — fabricated by creating a structure of polysilicon, removing some silicon and using chemical vapor deposition to deposit tungsten as a kind of backfill in the mold — the metal could handle quite high temperatures and have a large and absolute photonic band gap in the visible range where it is already known to emit light. But what would happen to the other,

lower-wavelength energies brought in by an electric current? Would the structure melt through the build-up of heat? Or, more desirably, would the thermally excited tungsten atoms reinforce emissions at higher wavelengths, such as in the visible frequency range?

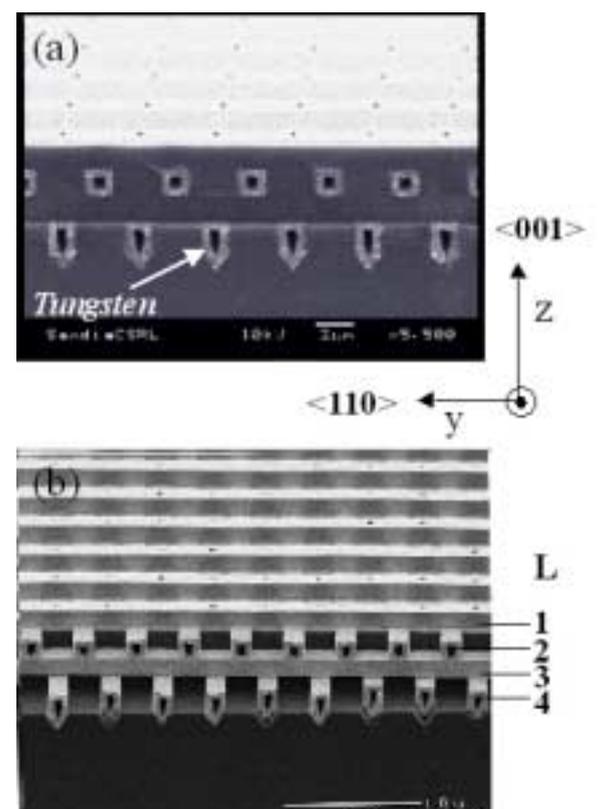
An order-of-magnitude enhancement

Energy at the edge of the photonic band was observed to undergo an order-of-magnitude absorption increase, or enhancement. This meant that energy was being preferentially absorbed into a selected frequency band. Meanwhile periodic metallic-air boundaries led to an extraordinarily large transmission enhancement. Experimental results showed that a large photonic band gap for wavelengths from 8 to 20 microns proved ideally suited for suppressing broadband blackbody radiation in the infrared and has the potential to redirect thermal excitation energy into the visible spectrum.

Thus, not only is a more efficient incandescent lamp shown to be possible, but photovoltaics also can be provided with energy from heat-generators that have transposed energy wavelengths into the most optimal frequencies.

All work was performed on commercially available, monitor-grade six-inch silicon wafers. These photonic devices were fabricated in Sandia's Microelectronics Development Laboratory using modifications of the standard CMOS processes originally developed for Sandia's radiation-hardened CMOS (complementary metal-oxide semiconductor) technologies.

The work was funded by the Laboratory-Directed Research and Development program through project manager James Gee (6200). Co-principal investigator Jim Moreno (6216) modeled the thermovoltaic results.



IMAGES OF A 3-D tungsten photonic crystal, taken by a scanning electron microscope. The images taken with and without oxide are shown in (a) and (b), respectively. The 1-D tungsten rod-width is 1.2 μm , the rod-to-rod spacing is 4.2 μm , and the filling fraction of tungsten material is 28 percent. The spacing of the rods acts to transmit certain frequencies of light. The structures show great promise for converting heat to light.

Arms control

(Continued from page 1)

the Path Forward to Peace.”

Although no formal agreements are negotiated at the conference, the meeting has become a primary policy-exploration and -discussion meeting for the world's arms control experts, who shape policy options for preventing proliferation and use of nuclear, chemical, and biological weapons that are eventually brought to the negotiating table by their respective nations.

The conference is sponsored by National Security and Arms Control Div. 5000.

'A rigorous gut check'

During the meeting's welcoming session, Senior VP Roger Hagengruber (5000) told participants, "We've seen as much change this last year, in relationships between the US and Russia, between the US and China, and between players in regional relationships, as we saw in the previous ten years, and the changes are far from over."

Sept. 11 meant a great deal to the United States, he added, but to the rest of the world it brought "a period of pause to reflect on whether it should change the norms for acceptability of actions."

John Wolf, Assistant Secretary of Nonproliferation, US Department of State, acknowledged criticisms of the Bush administration's "axis of evil" reference to Iraq, Iran, and North Korea.

"Let's be clear about this," he said. "These countries are seeking weapons of mass destruction, but they could not develop those weapons without foreign assistance."

He called for a "rigorous gut check" among nations that offer potentially helpful technical assistance and sales to proliferating nations.

"Just because a country hasn't been caught with biological weapons or chemical weapons, that isn't justification to sell them sensitive technology," he said.

US-Russian relations

Special presenter Lev Ryabev, First Deputy Minister, Russian Ministry of Atomic Energy, warned that US policy trends toward unilateralism are destabilizing.

He also registered the official Russian view that Bush-administration-proposed reversible cuts to the US nuclear arsenal — dismantling and storage of weapons and delivery systems rather than permanent destruction of them — make little sense to Russians in the context of US deterrence needs to counter a primarily terrorist or rogue-nation threat.

Tariq Rauf, head of Verification and Security Policy for the International Atomic Energy Agency, said from the European perspective, seemingly unilateralist Bush administration actions, especially the withdrawal from the 1972 Anti-Ballistic Missile (ABM) Treaty and commitment to pursue a missile defense capability, have "raised fears about the collapse of the current arms control regimes" but also "contributed to renewed interest in trying to

elaborate a new strategic framework" to restore strategic stability.

In a keynote address, Bruno Tertrais, Senior Research Fellow, Fondation pour la Recherche Strategique, France, said although the events of Sept. 11 did not fundamentally alter the strategic environment from a European perspective, they are shaping current US strategy, which is leading to a "conceptual gap between both sides of the Atlantic."

He said Europeans perceive a growing US disinterest in maintaining a US military presence on, and providing peacekeeping assistance to, the European continent.

"The EU should expect to take charge of peace operations in its backyard," he said.

And he offered frank advice for both the US and Europe.

"Those in Europe who are still mourning the loss of the ABM treaty should stop lamenting about an imaginary 'lost paradise' of strategic stability," he said, then added that the US has to consider the "long-term overall costs of drifting away" from multinational negotiations and not "underestimate the power of the norm" as set forth in international agreements, he said.

"The coming test is Iraq," he added. "The way the Iraqi problem will be solved, one way or the other, will have considerable impact on how we approach disarmament and nonproliferation, on how the rest of the world perceives our policies, and on transatlantic relations."

Risk of bioweapons

During a panel discussion on bioterrorism, Raymond Zilinskas, senior scientist with the Monterey Institute's Center for Nonproliferation, gave an account of the ready availability of technical information useful to terrorists pursuing bioweapons via technical papers, the Internet, and several US-published how-to manuals.

"Anyone possessing research skills with access to the Internet and a research library can find information relevant to producing chemical warfare agents, toxins, and bacterial and viral pathogens," he said.

He called for laws that strike a balance between limiting the availability of information useful to terrorists and protecting freedoms of speech and healthy scientific interaction.

"Strategies to control potentially damaging information must be adopted by Congress, executive agencies, and nongovernmental organizations," he said, "or else what is now merely a troubling issue is likely to become a real security hazard."

Marie Chevrier, associate professor at the University of Texas at Dallas School of Social Science, pointed out that attempted terrorist attacks using biological materials have caused what must be to the attackers disappointing death tolls. She suggested that because of the technical challenges of bioagent dispersal, the successful use of bioweapons on a scale resembling mass destruction is much more likely to be carried out by a state actor rather than a non-state actor.

"The appropriate question to ask in assessing the risk of terrorist bioweapons use is," she said, "under what circumstances would a terrorist group choose biological agents as weapons of choice?"



MORE THAN 230 ambassadors, policy-makers, academicians, and other experts representing 35 countries participated in the 12th Annual International Arms Control Conference in Albuquerque, sponsored by Sandia. (Photos by Bill Doty)

"The coming test is Iraq. The way the Iraqi problem will be solved, one way or the other, will have considerable impact on how we approach disarmament and nonproliferation, on how the rest of the world perceives our policies, and on transatlantic relations."

"The topics selected for this year's conference — arms control versus informal agreements and biowarfare, for example — were particularly timely and provocative given the US decision to withdraw from the Anti-Ballistic Missile treaty, the events and follow-on from 9/11, and the recent anthrax attacks," says Dori Ellis, Director of International Security Center 5300.

She says the conference was designed to provide a forum for international policy makers to have frank, open discussions in an unofficial setting. The evolving relationships among several world players provided a "backdrop for dialogue that was even more engaging than usual," she says.

"The conference lived up to its reputation of discussing the cutting-edge issues that impact the international community," says conference chairman Jim Brown (5302). "Several conferees indicated that the topics discussed were on the mark in helping them better understand US national security strategy in the post-9/11 environment."



TALKING POINTS — Ambassador Ahmad Kamal (left), retired representative of Pakistan to the United Nations, and retired Maj. Gen. Mahmud Durrani, Pakistan, have an intense discussion during a break.

Exercise stretches Sandia's emergency response muscles



Photos by Randy Montoya

A cigarette break gone horribly wrong launched the latest DOE-audited Labs-wide emergency response exercise on April 17. Under the exercise scenario, an employee flicked a cigarette carelessly, it was picked up, still burning, by a gust of wind and carried into the Bldg. 826 high bay. The cigarette smoker didn't notice.

As luck would have it, the butt landed on some rags near a gallon of mineral spirits. That fuel ignited, and subsequently involved foam components from two 500-gallon containers. Because there are only two employees in the building at the time, neither of them notices the fire until the high bay is fully involved. By the time they become aware of it, the smoke is rapidly getting thick. The employees manage to evacuate, but do endure moderate injury from smoke inhalation.

Emergency response personnel called for immediate evacuation of several nearby buildings and so-called shelter-in-place at several others.

The exercise involved several Sandia and Kirtland Air Force Base (KAFB) emergency response entities. Among them: the KAFB Fire Dept., the KAFB Rescue and Reconnaissance Team, Sandia Medical, and Sandia's Emergency Operations Center.

According to exercise coordinator Bruce Berry, positive aspects of the drill included: The Labs' EOC was quickly staffed; on the scene the KAFB Fire Dept. quickly mitigated the hazardous situation; plume modeling was done quickly and effectively.

In the area of what he called "opportunities for improvement," Bruce identified several items for additional work: improved communications between the field and EOC; increased education of employees about evacuation and shelter-in-place practices; improved information-gathering capabilities for staff handling the 911 phone line; shortening the time for getting medical care to injured personnel; and expanding training opportunities for all emergency response personnel.

Says Bruce: "This type of exercise gives emergency response personnel a chance to respond and practice what they have learned. Also, these real-world exercises offer an excellent opportunity to determine what works well — and not so well — and then develop a corrective action plan to improve the emergency response program. By practicing and demonstrating our emergency response capabilities, it demonstrates to DOE and the employees of Sandia that we have an active emergency response program and that we are continually improving our response to the incidents that can and might happen here at the Labs."



Thunderbird Award winners soar higher than ever

Program launched in 1994 by Sandia and Lockheed Martin honors kids who have overcome obstacles

By Iris Aboytes

Upon seeing an eagle, we initially are in awe of its magnificent wings and do not see the strength, power, or determination of this proud creature. How amazing that it mirrors a human in spirit and intestinal fortitude (guts).

Symbolic of these traits, the Thunderbird Awards were created in 1994 by Sandia and Lockheed Martin to reward young people possessing the ability and determination to overcome obstacles and afford themselves the opportunity to become tomorrow's leaders and positive role models to at-risk teenagers. The award carries with it a \$1,500 check awarded through the Albuquerque Public Schools Foundation.

Obstacles mean different things to different people. To Ruben it means becoming a father in your junior year of high school, working 35 hours a week to provide for your family, and still having

"We hope [the Thunderbird recipients] all soar as the eagle with strength and determination to realize their dream. It is awesome to provide a little help for their journey."

the optimism and determination to get a degree in computer technology. He will be the first family member to graduate from high school.

For Jesse it means starting high school with a 1.25 GPA. His freshman year in high school, his GPA was 1.333. Family and emotional problems dominated his life. Determined to overcome his difficulties, his next year was better, and the year after that even better. Jesse had "fallen in love" with learning, challenging himself and succeeding. He wanted to have the opportunity to go to college, and go fully prepared. His last-term GPA is 4.275.

Terrance's story is different. His alcoholic mother and father divorced when he was five years old. His mother's anger for Terrance's father was often taken out on him. His older sister succumbed to the drug scene. He vowed this would not happen



THUNDERBIRD AWARD RECIPIENT Terrance turned to his grandfather for support after his immediate family disintegrated in alcoholism, drug abuse, and abandonment. (Photos by Randy Montoya)

to him. By 11th grade, his mother had abandoned him. He worked double shifts six days a week and attended night school two days a week to keep up with school. Realizing he could not do it on his

own, he contacted his grandfather. He was determined to graduate but needed more support. If need be, Terrance is prepared to enter military service to help pay for college. He wants to be a doctor.

The reasons why these young people are Thunderbird Award Winners is obvious. They all possess perseverance, determination, work ethics, and the all-important resolve. These are but three of the 21 young people from 11 Albuquerque public high schools, five alternative schools, and five outlying schools (Bernalillo, Rio Rancho, Los Lunas, Belen,

Possible successor to E-Z-GO carts unveiled



LITTLE GTO? NOT! . . . but still a GEM — a Global Electric Motorcar, that is. One of the highlights of Earth Day 2002 activities at the Coronado Club was introduction of the GEM as a possible successor to the Labs' fleet of E-Z-GO carts, with which countless Sandians have cultivated a love-hate relationship over the years. The E-Z-GOs aren't lovable, but they sure beat a long walk across a rainy tech area. The GEM also provides a roof over your head, but in a stylish, 21st-century electric vehicle that doesn't rattle when you sneeze. Pictured here, Ed Williams, Manager of Fleet Services Dept. 10849, takes Melvin Johnson (9134) for a spin. (Photo by Randy Montoya)



T-BIRD RECIPIENT Terrance shares a moment at the office with his grandfather, an Albuquerque physician.

and Moriarty) who received their awards at a luncheon in their honor April 29 at the Sheraton Uptown.

"The Thunderbird Award is much more than money," says Mike DeWitte, Manager of Corporate Outreach Dept. 12650. "It is recognition for some great kids who simply haven't had much opportunity for that in their life. Furthermore, it is our demonstration of faith in them and their future as well as a rekindling of hope. We hope they all soar as the eagle with strength and determination to realize their dream. It is awesome to provide a little help for their journey."

Lab Directors meeting reflects new relationship



HISTORIC MEETING — Directors from the Russian and US weapons establishments convened near Santa Fe, N.M., April 13-16 for the second time since the end of the Cold War to discuss issues of common interest. Pictured are, back row from left: Everet Beckner, National Nuclear Security Administration (NNSA); Michael Anastasio, Lawrence Livermore National Laboratory (LLNL); Bruce Tarter, Director, LLNL; Joan Woodard, Deputy Director, Sandia Labs; John Browne, Director, Los Alamos National Laboratory (LANL); John Immele, LANL; and Dori Ellis, Sandia. Middle row, from left: Yuri Barmakov, All Russian Scientific Research Institute of Automatics (VNIIA); German Smirnov, VNIIA; Vladimir Rogachev, Russian Federal Nuclear Center — All Russian Scientific Research Institute of Experimental Physics (VNIIEF); Natalya Klishina, Minatom; Rady Ilkaev, VNIIEF; Georgi Rykovanov, Russian Federal Nuclear Center — All Russian Scientific Research Institute of Technical Physics (VNIITF); Evgeny Avrorin, VNIITF. Front row, from left: C. Paul Robinson, Director, Sandia; Lev Ryabev, First Deputy Minister, Minatom; John Gordon, Administrator, NNSA; and Linton Brooks, NNSA. (Photo by Scott Christopher)

By Bill Murphy

For Sandians who cut their teeth during the Cold War, it is still, even 10 and more years later, a jarring, extraordinary image: the group photograph of the directors of the Russian and US weapons labs convened for friendly dialogue at Bishop's Lodge north of Santa Fe.

Looking out from the photo are faces of men and women who, not much more than a decade ago, were sworn adversaries, developers and stewards of implements of war the use of which would bring utter destruction to their foes.

This northern New Mexico meeting April 13-16 was actually the second such gathering; the first was held in conjunction with the celebration of Sandia's 50th anniversary in 1999. At that meeting, attendees were limited to lab directors and their staffs; this time, their bosses — Gen. John Gordon from DOE's National Nuclear Security Administration and Lev Ryabev, First Deputy Minister of Minatom, Russia's atomic energy agency — were on hand, lending a policy-level viability to the directors' discussions.

Joan Woodard, Sandia's Executive Vice President and Deputy Director, says that many noted a distinct thawing of the atmosphere between the first meetings 10 years ago with the Russian labs and today. In those first meetings, she says, the atmosphere was described, understandably, as having a certain stiffness, a formality of expression, a perceptible sense — not of distrust — but of caution.

At the meeting last month, she says, the atmosphere was more relaxed; there was more trust, and markedly less subtext of questioning each others' motives for participating.

The fact is, Joan says, the Russian labs and the US labs share many concerns: knowledge preservation, materials control, and nonproliferation are just a few examples. And, of course, the big issue looming over all the directors' discussions: "the new world dynamics," as Joan put it, referring to the post-9/11 geopolitical situation.

At the 1999 meeting, Joan says, the directors talked about a lot of issues, but there was no final report at that time stating that, "We will now do x, y, and z." This time around, she says, with Gordon and Ryabev participating, there was support to take tangible steps to advance lab-to-lab cooperation.

"Having Gen. Gordon and Lev Ryabev there with us made a huge difference," Joan says.

As a result of the policy chiefs' participation, Joan says, two ideas for tangible action emerged from the meeting:

- First, the directors agreed (working under the

Sandia Executive VP Joan Woodard thanked a number of Sandians who helped make the lab directors' meetings a success. Among them: Dori Ellis (5300), Dave Nokes (5900), Bob Huelskamp (5327), and Tom Sellers (ret.). "They've really done a lot to put the foundation in place for this directors' meeting and our lab-to-lab relationships," Joan says.

auspices of existing US/Russian government-to-government agreements) to sponsor two workshops on how to collaborate and cooperate on technologies to counter terrorism.

• Second, the directors agreed to revitalize a moribund program of science collaboration among the labs. Some areas of cooperative effort under this initiative might include materials aging phenomena, high-energy physics, and other issues of concern to scientific management of nuclear stockpiles.

Joan shares an anecdote that, in her mind, sums up the status of US-Russian relationship, both among lab directors and at the nation-to-nation level.

During the discussion, she recalls, Rady Ilkaev, director of VNIIEF (the All-Russian Scientific Research Institute of Experimental Physics), displayed a cartoon with two frames; In the first frame, two dark-suited gentlemen stand rather stiffly apart, not cozy, but not overtly hostile. The caption says, "Not enemies." In the second frame, the two are closer together, smiling, and appear more relaxed in each others' company. The caption: "Partners?" With a question mark.

Ilkaev, Joan says, asked the rhetorical question: "Where are we in this picture? We are 'not enemies.' But are we yet 'partners?'"

"That is the very issue our governments are trying to sort through," Joan says. And meetings such as the Bishop's Lodge gathering, she says, position the national laboratories in both countries to follow their governments' leads as the nature of the relationship evolves.

Betty Boop adds more horsepower to her engine

By Iris Aboytes (aka, Betty Boop)

Rejuvenation technology for the new millennium is now possible. Get physical for fitness. Whoa! Hold on. Where are we headed? These statements make me crazy. (OK! crazier.)

OK, so I get "get physical for fitness," but what in the world does "rejuvenation technology for the new millennium is now possible" mean? It could mean "take inventory of your humanoid and adjust the fuel intake valve to produce more potent and pure energy."

If you adjust the intake valve and produce purer energy, does it keep you from blowing the engine? But getting physical is so sweaty. I bet Betty Boop never got sweaty. Can't I just sit and imagine what getting physical could achieve in a humanoid?

What about fuel? It takes some element to pro-

¡SALUD!'s Employee Health and Fitness Day 2002

Wednesday, May 15, is ¡SALUD!'s Health and Fitness Day: Participate in three of six activities to earn an event T-shirt.

Bike to Work Day. 6 a.m.-8 a.m., Wyoming Gate.

Exercise Your Mind. Dr. David Scherer speaks on "Warning Signs of a Troubled Teen," noon-1 p.m., Bldg. 825, Steve Schiff Auditorium.

Fitness Activities, Hardin Field, 11 a.m.-1 p.m.

- NIA - No-Impact Aerobics
- Core board
- Martial Arts
- Yoga

Browse the Health Services Center Weekly Update for more: www-irm.sandia.gov/HR/health/update/index.htm.



BETTY BOOP says, "Let's get physical, physical." Here several Sandians exercise to maintain good health. All Labs employees have the opportunity to "get physical" Wednesday, May 15, during ¡SALUD!'s Employee Health and Fitness Day 2002. (Photo by Bill Doty)

duce pure energy. Imagine avocados, tomatoes, cucumbers, lettuce, and flower seeds for lunch, especially on a hot summer day. Top that with a candy bar. Just kidding! Now that would be alternative fuel! (Margie Tatro, 6200, where are you? Help me out here.)

Now I've got it. To be a lean mean human machine, I have to eat my veggies, exercise, and get enough rest. Boring! OK! So what is it that I want? Is it worth it? Well, here goes.

I want to have the determination of a 2-year-old, the energy of a three-year-old, the metabolism of a young basketball player, the sense of humor of

a 5-year-old (they make up their own jokes), and the wisdom of an 80-year-old. I think I will stop there. No, I forgot one — I would like to possess the ability to always laugh at myself.

This is probably not what rejuvenation technology means, but this is what it means to me. Exercise, good nutrition, and positive attitude (positive attitude throws your engine into overdrive) keep humanoids' engines roaring. All humanoids! Betty Boop says, "Let's get physical, physical."

P.S. You thought this article was going to be silly. Be honest. You did, didn't you? Wrong! Think about it.



Photos by Randy Montoya

Bombs away! National Atomic Museum moves its weapons displays to new location in Old Town

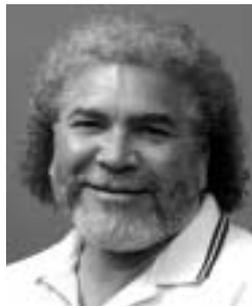
As the grand re-opening date of May 12 approaches, the National Atomic Museum staff is scrambling to complete the exodus from its long-time home on Kirtland Air Force Base to a new building in the heart of the Old Town museum complex. Among the more striking sights to be seen during the move was the flatbed trailer loaded with a full-scale mockup of MIRV reentry vehicles (below) and other weapon components. In the photo at left, long-time museum staff member and exhibit designer Tom Salazar helps guide a 1/4 scale Titan IIIC booster through a loading door at the new museum location, formerly the REI building, next door to the New Mexico Museum of Natural History and Science. Despite some skepticism from onlookers, Tom and his colleagues negotiated a couple of very tight turns and narrow aisles and successfully mounted the 30-foot-long model in its place of honor near the front of the museum. Meanwhile, a dungaree-clad Museum Director Jim Walther paused from a morning of heavy lifting to say that the move to the new location is "the best thing that could have happened to us, even though it was brought on by [the] tragedy [of 9/11]." (The KAFB site was effectively closed to the public as a result of security requirements following the terrorist attack on the U.S.) Jim, who says the museum still has long-term plans to move to a larger site and as-yet-unbuilt facility at Balloon Park, says the move to Old Town affords an opportunity "to test the premise that we can attract visitors off-base." As the grand opening date approaches and displays are still in crates, Jim dismisses a drop-in visitor's concern that the new museum won't be able to open on schedule. "We'll be ready," Jim says. "We're Sandians. We're supposed to be able to pull it off."



Mileposts



Curtis Cofield
35 8232



Lacey Learson
30 10262



Daniel Hardin
25 8241



William Hendrick
25 10824



Sharon Walsh
20 9327



R. Michael Bell
15 8232



Kathryn Hughes
15 8205



Robert Kinzel
15 8244



James Lauffer
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R. Mark McConkie
15 8232



Karen Scott
15 8524



Tracy Walker
15 9329



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Feedback

Sandia's ethos: Senior VP Roger Hagengruber talks about what it means to be a Sandian

Q: *I've heard some folks around here, particularly those in what we're now calling the Integrated Enabling Services (IES) area, discussing Roger Hagengruber comments made earlier this year about the Labs' ethos and our need to remind ourselves periodically of that ethos, which my dictionary defines as "the disposition, character, or fundamental values peculiar to a specific people, culture, or movement." So what does Roger think Sandia's ethos is?*

A: NOTE: Roger thought the best way to respond to this question is through excerpts of a talk he made earlier this year during an all-day meeting of IES managers and directors. The purpose of the talk was to provide his perspective on "the mission need" for the Labs' concurrent IES and governance initiatives.



ROGER HAGENGRUBER

"If you're waiting for someone to say you're the best Lab, the best people, you're the best everything, you'll be here a long time waiting for that. That type of insistence of recognition is not a Sandia trait. What Sandians must do to be this [holding up the Labs Vision and Highest Goal card] is to react when the nation faces problems and not worry about recognition and praise and appreciation. Instead they should revel in the satisfaction of doing a good job.

"I just want to say up front that the Labs will endure. We have enormous and great prospects for the future because the country faces a future of great prospects but also some uncertainties. We're one of the insurance policies that make it possible for this country to look with confidence into the future knowing that it can respond to threats or if another 9/11 comes in the future. It's what makes you proud to be a Sandian: to go home at night

and pick up *Newsweek* and read it and say, 'We did that stuff at Sandia.'

"This Lab is a partnership. Without you [the various IES functions] there would be no lab at all. Without the guards we have no lab. Without the people who do the budget, without the people who take care of the facilities there is no lab, and the technical people fail when they fail to recognize the fact that you're absolutely indispensable.

"Let me talk a little about Sandia's ethos and my experience with it. In many respects AT&T planted seeds of the ethos. The first was that the top of the flagpole at Sandia was always the national interest. The flag of the national interest came before anything. Then came our customers, then our laboratory, then our organizations, then ourselves. But the national interest was always first.

"Second of all, Bell Labs had and Sandia has today — all great labs have it I think — a sense that we can do anything. We can't, in fact, do everything, but that belief, that hope, that faith that somehow we can deliver, that we can bring science to bear on the nation's most-pressing problems and, in fact, solve them, is part of the Sandia ethos. You don't have to write it down. You don't have to learn it from scratch. It's what we do.

Finally, AT&T brought — and Lockheed Martin has built on it — a day-in and day-out business-like approach to all our endeavors.

"I've been proud to be part of this Lab for all these years and I think you should be too. We just have to have a single objective and it's not about your success, your organization's success, the success of enabling services, it's about that one thing — service to the nation and striving to be exceptional. That is what we strive for.

"I've had a number of opportunities to leave the Lab and I remember one guy who was offering me a very lucrative job who asked me, 'Why do you work at Sandia?' The answer popped into my mind right then. It was, 'Because north is always the same direction at Sandia.'"

— Roger Hagengruber, Senior VP, 5000

Symphony Under the Stars

Sponsored by Lockheed Martin and Sandia

STARS & STRIPES!

New Mexico Symphony Orchestra

Mike Krajewski, conductor
Saturday, May 18, 8 p.m.

Rio Grande Zoo

Special offer for Sandia employees, contractors, and retirees — 20 percent discount on ticket prices:
\$12.40 lawn; \$15.50 chair.

- The zoo will be open at 6:30 p.m. and the concert begins at 8 p.m.
- Purchase your tickets at the NMSO Ticket Office at 3301 Menaul Blvd. NE.
<http://www.nmso.org>

For information, call Pam Catanach
(12650) at 284-5211

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MISCELLANEOUS

WASHER & DRYER, Maytag, 5 yrs. old, excellent condition, stored past 4 mos., \$500 OBO. St. Clair, 821-0077.

LOBO BASKETBALL, signed by Fran Fraschilla, best offer. Easterling, 298-7083.

ESTATE SALE, May 3-4, 8 a.m., 9824 Riverside Rd., follow signs on Alameda near Rio Grande, Hostetter, 898-3785.

CAMCORDER, JVC Compact VHS-C, new in box, AC adapter, battery pack, cassette adapter, \$260. Skolnick, 293-7206.

REFRIGERATOR, Whirlpool, 26 cu. ft., w/ice/water dispenser, almond, \$450; built-in 30-in. oven/microwave, black, \$150; built-in dishwasher, black, \$60. Stein, 250-1120.

SOFA & LOVESEAT, Drexel, white, formal, like new, \$600 both; antique teacart, \$145, brass day bed, \$80. Romero, 296-8493, after 5 p.m.

SOFA (90-in.) & CHAIR (46-in.) matching, TEMA, off-white, textured fabric pillows, 2 yrs. old, \$300 OBO. Aas, 856-6674.

DINING ROOM SET, Formica, w/6 swivel chairs, comfortable, vinyl backs, fabric seats, 2-arm, \$100. de la Fe, 271-6694.

DINING ROOM TABLE, solid oak, 42" x 42", w/4 chairs & two 18-in. leaves, \$300. Bauer, 299-0640.

WEIGHT SET, 350-lb., adjustable bench, leg attachment, 45-lb. barbell, 10-lb. uneven bar, 2 dumbbells, \$200 OBO. Russell, 247-9748.

DINING SET, platform beds, full & queen-size, gorgeous teak table, Bassett chairs, like new, sacrifice, \$499. Otto, 242-6199.

GRAVEL, 7/16-in., Santa Fe brown, 2 tons, you haul, \$65. Locher, 266-2021.

ROUTER, Craftsman, 1-1/2-hp, w/deluxe router table, \$90; Mongoose, 18-spd. mountain bike, w/helmet, \$85. Hunt, 858-1927.

GARAGE SALE, May 10-11, 9912 Karak Rd. NE (north on Eubank, past Academy, left on Coronado, left on Wadi Musa, right on Karak). Weagley, 821-4263.

MOVING BOXES, lots, free. Draper, 899-3155.

DIRT BIKE LOADING RAMP, aluminum channel, 6-1/2 ft., good condition, \$35; terracotta chandelier, \$35. Hesch, 350-9903.

GASOLINE SAW, 16-in., Homelite XL Textron, automatic oiling, \$75. Anderson, 232-2167.

GRAND PIANO, Kimball, 5 ft., walnut, beautiful, excellent condition, \$2,500. Epperson, 271-9880.

VACUUM CLEANER, Eureka Excalibur, 12-amps, great condition, rarely used, \$45 OBO. Malcomb, 294-6975.

AIR BAND TRANSCEIVER, ICOM A22, like new, comes w/Telex Echelon 100 headset, list \$720, asking, \$350. Werner, 296-8008.

KITCHEN CABINETS, medium oak, upper, \$25 ea., lower w/drawers, \$35 ea., one, 4-drawer set. Tate, 298-9512.

POOL, 15' x 36', frame, filter pump, cover & ladder, 30-min. set-up, used two summers, \$125. Phelan, 869-6094.

DINING SET, antique, cherry, Duncan Phyfe, w/6 chairs, leaf, \$1,500; glass-front china cabinet, \$850. Smithpeter, 856-7047.

KITCHEN SINK, double, cast iron, beige color w/faucet, \$35. Stiles, 275-2941.

CELL PHONE, Motorola StarTac 3000, w/wall charger, car transformer & holster, \$50 OBO. Armijo, 552-9762.

SEWING MACHINE, Singer, antique, top needs work, \$175; 2 dark-wood end tables, \$40; Huffy girl's bike, 5-spd., \$40. Torres, 271-9436.

QUEEN-SIZE WATERBED, 2, w/6-drawer pedestal, \$100 ea.; queen-size waterbed frame & riser, \$40 OBO; bikes: 20-in., 12-spd, \$70, 18-in., \$40. Nation, 298-5605.

WASHER & DRYER, Sears, excellent condition, \$350 OBO. Jones, 294-3079.

COMPUTER DESK & BOOKCASE, white-washed, excellent condition, great for child's room, \$150. Brionez, 821-0868.

ARTS/CRAFTS SHOW, "Cherished Creations" Cottonwood Mall, May 10-11, free parking, free admission, mall hours. Self, 296-4137.

CANVAS TENTS, w/frame, 10' x 12', excellent condition, each tent fits 4 cots comfortably, \$320; cots, \$25 ea. Gutierrez, 350-5064.

MOVING BOXES, free; Kenmore dishwasher. Furnish, 884-6626.

WICKER STAND, 3 shelves, 2 drawers, \$60; rocking chair, \$20; end table, 2-tier, circular, \$5; shoes/boots, ladies, 6-7M. Ristorto, 823-4591.

CROSS-COUNTRY SKI MACHINE, Weslo Cardio Glide & Vitamaster, great shape, \$100 both. Drennan, 897-7153.

FIREWOOD, from downed cottonwood tree, in Corrales, you haul, free. Howarth, 897-3082, ask for Susan.

CAMPER SHELL, fits LW bed, \$50; coffee & end tables, \$60; girl's 10-spd. bike, \$55. Nutt, 856-8267.

GAS DRYER, Kenmore, great condition, \$150; 27-in. console TV, \$100; desk chair, \$50 OBO. Beltz, 238-8072.

CHARCOAL BBQ, \$25; stereo entertainment cluster, \$35; extra speakers, \$20; walnut cabinet, \$10; washtub, \$5. Reed, 821-7782.

MODEMS, US Robotics, Sportster, Data/Fax, ISA, 14.4Kbps, \$3; 33.6Kbps, \$7. Sinton, 828-9672.

GAS LAWNMOWER, 2 yrs. old, 6-hp., Sears Craftsman, 21-in. cuts, excellent condition, includes bag, \$125. Chavez, 831-3193.

TERRARIUM, for reptiles, etc., oak & glass, lighted, 150-gal., 5.5' x 2.5' x 1.5', w/accessories, \$225. Abbin, 344-4062 or 296-7678.

RUMMAGE SALE, May 4, 8-3, Jefferson Middle School parking lot, Girard & Lomas, benefits Girl Scout troops 3292, 5130 & 6001. Morgan, 256-0294.

STEREO CONSOLE TV, 27-in., Sony Trinitron, universal remote, VCR shelf, new \$750, asking, \$350. Schuster, 828-3415.

HARDWOODS, priced per bf.: red, white oak, \$2; cypress \$3; African walnut, \$4; zebrawood, \$6. Fleming, 293-9421.

FOUR TIRES, Goodyear Eagle, P185-65-R14, used but good condition, lots of tread left, free. Buteau. 856-7705.

FURNITURE: Ethan Allen, dining room, \$1,500; entryway, \$400; 52-in. TV, \$750; stamp collection, \$400; diamond ring, \$2,200. Phelps, 821-1151.

COKE MACHINE, '50s vintage, Vendo V-83, great original condition, everything works, 10c mechanism, \$2,000 OBO. Thornberg, 869-0421.

EMBROIDERY MACHINE, Brother PE180D, new, unopened, comes pre-programmed w/all Disney characters, MSRP \$1,500, asking \$900. Hardesty, 298-0695.

REFRIGERATOR, White-Westinghouse, 18 cu. ft., almond color, great condition, \$225. Denman, 792-0394.

STORAGE UNIT, wicker, \$25 OBO. Kincaid, 296-6014.

TREADMILL, Vitamaster, \$85; Vitamaster Exercycle, \$45; HP 5L LaserJet printer, \$65. Hale, 298-1545.

SOUTHWEST AIRLINE TICKET, one roundtrip, expires 7/26/02, \$300; Creative Memories albums & supplies, 15% discount. Forster, 293-7231.

COUCH, high back, reclining & loveseat, excellent condition, moving must sacrifice, \$700. Flores, 896-2047.

LOVE SEATS, 2, w/matching chair & ottoman, \$250. Chorley, 296-1454.

WINDOWS, 7, 3-8/6-0 dual-pane; 6, 32-in., bi-fold metal doors, 100 2625 BTU phase-change thermal storage rods. Talbert, 298-9036.

BEDROOM FURNITURE, oak, queen pier grouping w/mattress, box springs, frame & dresser, photos available, \$750. Gruebel, 323-2414.

RIDING LAWN MOWER, John Deere, 9-hp, w/garden wagon, recently replaced drive belts, good condition, \$500 OBO. Olson, 299-2152.

BOOKS, Star Trek, 12, 50c ea.; auto-graphed copy of Donna Hartley's book, *Fire Up Your Life* from 2001 OPQC conference, \$8. Bristol, 843-9490.

SOFA & LOVESEAT, cream w/floral pattern, \$300 both; rose-colored wing-back chair, \$100; large executive desk, \$100; lamps, \$40 pr. McMahan, 822-1301.

SLEEPER-SOFA & LOVESEAT, queen-size, \$450; weightlifting equipment (bench & lat machines), plus weights. Witkowski, 271-1691.

FIREWOOD, free. Moss, 298-2643.

BABY ITEMS: crib w/mattress, Pooh mobile & lamp, bathtub, car seat/stroller combo, swing, playpen, call for prices. Lopez, 831-0777.

EXERCYCLE, large, \$100; stereo cabinet, teak wood, new, \$350; stereo, Fisher, CD/cassette; trundle bed w/accessories, \$300. Torres, 352-0113.

How to submit classified ads

DEADLINE: Friday noon before week of publication unless changed by holiday. Submit by one of these methods:

- E-MAIL: Michelle Fleming (classads@sandia.gov)
- FAX: 844-0645
- MAIL: MS 0165 (Dept. 12640)
- DELIVER: Bldg. 811 Lobby
- INTERNAL WEB: On Internal Web homepage, click on News Center, then on Lab News frame, and then on the very top of Lab News homepage "Submit a Classified Ad." If you have questions, call Michelle at 844-4902. Because of space constraints, ads will be printed on a first-come basis.

Ad rules

1. Limit 18 words, including last name and home phone (We will edit longer ads).
2. Include organization and full name with the ad submission.
3. Submit the ad in writing. No phone-ins.
4. Type or print ad legibly; use accepted abbreviations.
5. **One ad per issue.**
6. We will not run the same ad more than twice.
7. No "for rent" ads except for employees on temporary assignment.
8. No commercial ads.
9. For active and retired Sandians and DOE employees.
10. Housing listed for sale is available without regard to race, creed, color, or national origin.
11. Work Wanted ads limited to student-aged children of employees.
12. **We reserve the right not to publish an ad.**

TRANSPORTATION

'95 EAGLE VISION, all power, climate control, AM/FM/CD/cassette, garaged, excellent condition, 142K miles, mostly highway. Kercheval, 266-5833.

'93 TOYOTA FORERUNNER, 4WD, SR5, 5-spd., CD, moon roof, garaged, service records, 130K miles, exceptional condition, \$9,500. Contreras, 344-2492.

'90 FORD F-150 LARIAT XLT, AT, AC, PW, cruise, excellent condition, 68K miles, \$5,300. Sanchez, 865-0527 or 865-1817.

'88 CHEVROLET SUBURBAN, engine & transmission problems, will sell for salvage of parts, make offer. Rogers, 256-0066.

'00 CORVETTE COUPE, 6-spd., performance additions, CD Bose sound, immaculate, 4,700 miles, great car, great price, \$43,000. Gillingham, 281-1842.

'84 TOYOTA PICKUP w/Xtra cab, 5-spd. manual, 1/2-ton, 2WD, 82.5K miles, \$2,150. Lockwood, 821-6331.

'94 CHEVY Z71, extended cab, 5.7L, 4x4, PSPB camper shell, w/carpet kit, excellent condition, \$11,200 OBO. Munoz, 259-2094.

'99 TOYOTA SOLARA SLE, V6, fully loaded, CD, leather interior, 44K miles, excellent condition, \$15,900. Aponte-Rexach, 260-1317.

'97 FORD THUNDERBIRD, V8, red, moon roof, only 50K miles, exceptionally well maintained by compulsive owner, \$8,500. Glenn, 345-7313.

'94 CHEVROLET BERRETA, 2-dr. coupe, V6, AT, loaded w/options, extra clean, 94K miles, \$3,900 OBO. Sturgeon, 281-9035.

'99 GMC YUKON, 4-dr., 4WD red, rear AC, leather, every available option, 45K miles, \$18,900. Krause, 858-1289.

'00 JEEP CHEROKEE SPORT, 2WD, V6, AC, PS, PW, PL, PM, tint, keyless, runs & looks new, 24.9K miles, \$13,450. Rivera, 292-4703, ask for Jonathan.

'87 JEEP CHEROKEE LTD., 4WD, 4-dr., AT, AC, power everything, very good condition, 167K miles, \$3,650. Dressendorfer, 292-5695.

'00 FORD F250, Super Duty pickup, V8, 4WD, AT, loaded, aluminum/alloy wheels, running boards, trailer/towing camper package, 30K miles, excellent condition. Watkins, 884-7015.

'91 MERCURY SABLE SW, AT, all power, 97K miles, \$3,125; '93 Saturn SL2, manual, AC, PW, PL, rigged to tow, 92K miles, \$3,125, will sell only one. Halasz, 821-2814.

'00 F150 XLT, extended cab, long bed, 5-spd., 4.6L, V8, towing package, power everything, 24K miles, excellent condition, \$15,800. Bolin, 530-9738.

'91 NISSAN PATHFINDER, Special Edition, black exterior, grey interior, AC, sunroof, very clean, 140K miles, \$6,200. Harmeson, 296-5489.

'93 FORD TAURUS LX, looks good, drives great, needs minor work. Holbrook, 828-1316, after 5 p.m. (www.kellidawn.org/temp/taurus_lx.jpg.)

'88 GMC JIMMY S-15, 4.3L, 4WD, AT, new brakes, radiator, starter, 12K miles on new automatic, \$2,250. Reich, 281-3521.

'98 DODGE DURANGO SLT, 4WD, white, CD/cassette, rear AC, cruise, tilt, privacy glass, new tires, 69K miles, \$16,400 OBO. Lipke, 271-0645.

'87 JEEP CHEROKEE WAGONEER LIMIT-ED, 4WD, 4.0L, AT, rack, new tires, garaged, very reliable, \$2,700 firm. Woodfin, 281-2702.

'94 JETTA III GL SEDAN, AC, AM/FM/cassette, sunroof, 65K miles, book value, \$5,340, asking \$5,000. Sanchez, 865-1776.

'94 FORD RANGER, new clutch, 70K miles, \$3,500 OBO. Archibeque-Guerra, 232-0419, ask for Andy.

'88 SUZUKI SAMURAI, 4X4, 5-spd., AM/FM/cassette, soft top, jump seat, 124K miles, runs strong, \$1,750. Kureczko, 286-4426.

'98 INFINITY QX4, all the extras, leather, sage green, sunroof, excellent condition, 51K miles, \$19,000. Brooks, 315-3998.

'98 CHEVY SUBURBAN, Silverado, 4WD, AT, AC, trailer package, original owner, excellent condition, 107K miles, \$4,900. Jones, 292-1581.

'87 JEEP CHEROKEE, 4x4, 4-dr., 5-spd., new tires, clean inside & out, \$2,600. Cleland, 281-2228.

'87 VOLVO GLE, 4-cyl., standard, leather interior, like new, garage-kept, 152K miles, \$4,250. Kranz, 822-0174.

'88 MERCURY COUGAR XR-7, 5 L, V8, white, excellent condition, perfect body, only 96K miles, \$2,300. Brown, 884-8581.

'97 TOYOTA COROLLA, burgundy, standard, tinted windows, new tires. Gomez, 604-3245.

'97 HONDA ACCORD, Special Edition, 4-dr., AT, cruise, 30+ mpg, 90K miles, \$9,000. Swier, 281-7430.

'98 FORD WINDSTAR GL, V6, 3.8L, AC, AM/FM/cassette, tinted windows, silver, 98K miles, mostly highway, \$9,500. Napier, 798-9489.

'90 ACURA LEGEND COUPE, LS, white, 5-spd., PS, PW, power seats, sunroof, leather, airbag, ABS needs reset. Mora, 291-1250.

'01 SUBARU OUTBACK, L.L. Bean Edition, white/silver, loaded, like new, \$22,800. Tharp, 792-5163.

RECREATIONAL

'01 YAMAHA 650 V-STAR CLASSIC, green/gold, w/windshield, Cobra pipes, jet kit & cover, \$5,500. McCubbins, 505-577-7883.

TANDEM BICYCLE, Cannondale, 22-in./18-in. aluminum frame, hydraulic brakes, extra wheels, w/mountain tires, Yakima carrier, \$500 OBO. Martin, 828-1247.

'92 TIOGA ARROW, 27-ft., class C motorhome, sleeps 6, excellent condition, 60,700 miles, \$19,000 OBO. Hahn, 822-1341.

GO-CART, 5-hp engine, seats 2, custom roll bar, disc brake, new Torque-A-Verter clutch, \$600. Thomas, 262-0171.

'00 HARLEY ELECTRA GLIDE CLASSIC, perfect condition, very nice extras, 6K miles, \$20,500. Tarango, 232-9543.

'93 AWARD 27-ft. travel trailer, Light Load, AC, microwave, stereo, TV hook-up, well maintained, book \$12,500, asking \$9,500. Burstein, 821-6688.

'88 HONDA SHADOW, 1100cc, windshield, extras, nice cruiser, \$2,200 OBO. Kolb, 299-3403.

TENT TRAILER, not pretty, great for summer camping, very easy to tow, \$150 OBO. Sanchez, 866-4225.

'99 HONDA CBR900RR, black/white/red, great bike, few extras, 7,600 miles, \$6,900. Shelton, 797-5008.

TROLLING MOTOR, Minkota electric, turbo model, long shaft, 30-lb. thrust, excellent condition, \$40 OBO. Patrick, 265-4569.

'94 NOMAD, 26-ft., fully self contained, equalizer hitch, 2 stabilizer bars, excellent condition, \$10,500. Zamora, 899-6330.

MOUNTAIN BIKE, Zacko Tacoma Trail MTB-2, 26-in., 21-spd., blue/silver, never used, \$100. Douglas, 281-9843.

'02 HARLEY DAVIDSON FATBOY, red/silver, many extras, extended warranty available, \$19,900. Fisher, 896-9450.

'94 STARCRAFT 1810, Bowrider, 18-ft., 180-hp, I/O Mercruiser w/trailer, great lake boat, \$7,500. Crine, 292-5321.

'00 HONDA CBR600F4, V&H race exhaust, yellow & black, less than 4K miles, never wrecked. Seyl, 363-2219.

'98 POLARIS EXPLORER 300, ATV, 4x4, good for hunting & playing, \$3,500. Butler, 832-4651.

BOY'S BICYCLE, Huffy, 18-spd., 24 x 2 tires, orange & black, 15-in. frame, w/helmet, like new, \$30 OBO. Drotning, 821-9598.

'89 OPEN ROAD CLASS A, 31-ft. base-ment model, 5.9L Cummins diesel, loaded, very clean, \$28,000. Branscombe, 881-4589.

'79 CAMPER/TRAILER, Aristocrat, 20-ft. tandem, bumper-pull, self contained, excellent condition, w/extras, must see, \$3,500 OBO. Garcia, 281-5490.

REAL ESTATE

5 ACRES in East Mountains, view, private gated community, w/available utilities & phone, great water & neighbors, \$62,000, includes road & water memberships. Smith, 281-5096 or 286-8558.

2-BDR. MOBILE HOME, in Four Hills Mobile Home Park, many amenities, close to Eubank gate, \$22,000. Lucero, 299-6842.

3-BDR. HOME, 2-1/2 baths, 2-car garage, 1,719 sq. ft., Ventana Ranch, Paradise Hills, great lot in cul-de-sac, only one neighbor, FSBO, \$129,000. De La Rosa, 249-0993.

3-BDR. HOME, 1-3/4 baths, 2-car garage, 2,100 sq. ft., RV pad, 2 blocks from Sandia High School, \$157,000. Rice, 352-7590.

1/2 ACRE, Rio Rancho, on cul-de-sac, just west of Unser, north of Southern, enjoy mountain & city views. Montoya, 345-0512.

3-BDR. BRICK HOME, 1-3/4 baths, 1,510 sq. ft., NE, near park & library, \$10K rebate for closing by June 30. Deepesh, 238-9381.

2-BDR. MOBILE HOME, '92 Cavco double-wide, 24' x 65', den, Four Hills Mobile Home Park, senior leaving state, must see. Martin, 323-2182.

4-BDR. HOME, 2 baths, 2,500 sq. ft., quiet cul-de-sac, 10 minutes from Eubank gate, \$185,000. Byle, 275-9157.

3-BDR. MOBILE HOME, double-wide, 2 baths, newly painted, many extras, 55+ NE Heights park. Taylor, 822-9819.

WANTED

GAMEBOY COLOR GAMES, used, good working condition, reasonably priced. Bristol, 843-9490.

GOOD HOME, for black cat, young female, "Spook," green eyes, nipped ear tips, affectionate. Dubicka, 296-6557.

BICYCLE CHILD SEAT, less than 10 yrs. old, good condition, reasonable price. Shollenberger, 237-2677.

CANOES, Scout troop needs canoes for river trip in July, donations welcome or inexpensive purchase. Reese, 281-6658.

CELL PHONE, Nokia 8290, Voice Stream phone, new or used. Salas, 730-2400.

BADMINTON PLAYERS, novice-expert, existing badminton club welcomes players, Monday evenings, NE gym. Carne, 822-1738 or Shierling, 888-3458.

SLIDE PROJECTOR, Kodak Carousel, 35mm, (or lens assembly for Carousel 850H projector, missing from ours). Frazier, 828-1958.

WORK WANTED

RESPONSIBLE TEENAGER, for landscaping, lawn maintenance, other miscellaneous chores, NE Heights area preferred. Ritchey, 299-7082.

'Take Our Daughters to Work Day' at Sandia

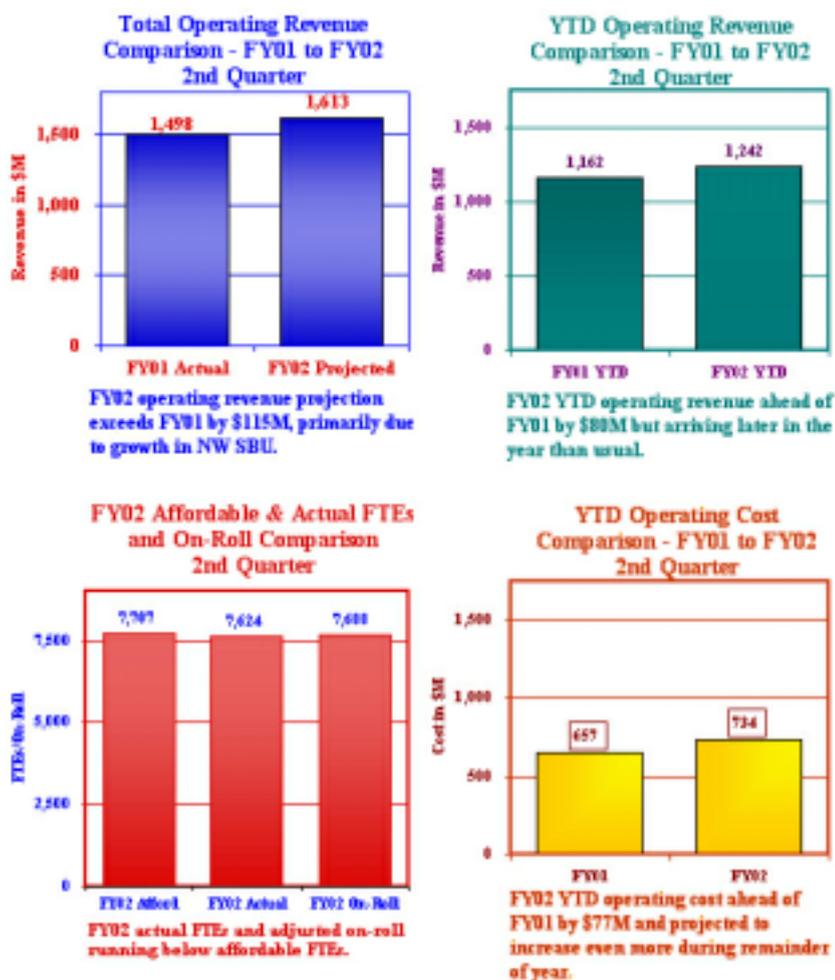


FOR THE NINTH YEAR RUNNING, Sandians on April 25 brought their daughters to work, and boy did the girls have fun. They reveled in the sheer joy and wonder of discovery of a kind that only science and engineering can inspire. The nationally observed day, a project of the Ms. Foundation designed to introduce girls to the diverse career options open to them as they grow up, has always been a popular Sandia event. This year, a variety of planned activities and tours gave participants a broad overview of the Labs and its mission. And again this year, for the second year in a row, *Lab News* photographer Randy Montoya brought his daughter Laura, 10, to work — and gave her a camera. These are her photographs. In the picture above, Sandia Archivist Myra O'Canna talks Labs history with three young visitors, from left, Arielle Romero, 10, Amy Drumm, 11, and her sister, Hannah, 10. In the photo at right, Z machine technician Ruth Smelser (1677) shows her daughter, Marnie Laird, a thing or two about helping maintain one of the crown jewels of Sandia's high-energy physics research.



Spotlight on Sandia financials

Below is a quarterly report of Sandia's financial health. The charts were developed by Frank Figueroa, VP 10000 & CFO, and people in the Controller's Organization 10500 specifically for publication in the *Lab News*. They show Sandia's financial status in various areas. The charts are updated and published quarterly. The subject matter of three of the charts — those dealing with total operating revenue, year-to-date operating revenue, and affordable vs. actual full-time-equivalent employee counts — are the same each quarter. The fourth chart highlights a different aspect of Sandia's financial health each quarter. For this report, the chart compares year-to-date operating cost from FY01 to FY02. FY02 cost exceeds the comparable FY01 cost by \$77M and is projected to increase even more during the remainder of the year, but appears on track to fall short of current projections by about \$70M. These charts are updated and published each quarter. They are intended to keep you informed of the Labs' financial health.



Feedback

Crickets, nay (for now); frequent flyers, aye (at last)!

Q: In the course of my work as a project manager, I carry a cell phone in order to respond immediately and keep projects moving along. The monthly bill for this modest and strictly business use averages about \$40. I understand from the Sandia construction inspectors that they use their cell phones a great deal more and their monthly bills can exceed \$125. So, my question is why hasn't Sandia renegotiated our cell phone service with Cricket or a similar one-fee provider? I never use my cell phone for long-distance calls, but need to reach local numbers exclusively. Cricket service is more reasonably priced and would save Sandia significant amounts. Any plans for something like this? Perhaps this would make sense for employees who use their cell phones extensively to return local calls. Can such an option be considered?

A: There is one overarching hurdle to overcome. In the current Sandia rules for cell phone use, Personal Communications Service (PCS) phones have been specifically banned (see www-irn.sandia.gov/security/safeguards_man/phone.htm (E1011)). We continue to work with Security and Procurement to see if Sandia is able to change this policy and improve the cellular/PCS services for Sandia with appropriate security.

Our group was on the technical review committee for the cellular telephone contract a number of years ago and the main reason Sandia went to a blanket contract was to avoid having to manage several hundred individual contracts with multiple providers, as was the case at the time.

Also, at that time, cellular was the only real alternative for wireless service (MetroMobile was the provider). Personal Communications Service (PCS) such as Sprint and Cricket had not yet come into being. VoiceStream was the first PCS to come into Albuquerque and its system (due to few available cells) would not penetrate most of the buildings on the base and did not provide the necessary service quality. Issues such as roaming and incompatible systems (GSM and CDMA) were also a problem for Sandia needs.

Today, however, PCS has become almost as ubiquitous as cellular. With the major players such as Sprint and Verizon each buying one of the six blocks of PCS spectrum, the system is almost on par with cellular. The cell phone contract is up for rebid in February, so this might be a good time to have consideration given to the PCS providers. They may be able to provide comparable service at a much lower rate, if PCS phones are allowed by policy. —Pace VanDevender (9400)

Q: The House (H.R. 2456) and Senate (S. 1498) have recently both passed legislation permitting federal employees to keep frequent-flyer miles earned on government-paid air trips. Are there any indications that the same benefits will be extended (returned) to Sandians?

A: Yes, Sandians are included in the frequent-flyer bill that was signed into law by President Bush on Dec. 28, 2001. It pertains to any traveler who is directly reimbursed with government funds. The law includes all travel benefit programs (air/hotel/car) and is retroactive, allowing travelers to personally use miles/points earned before the bill's enactment. —Bonnie Apodaca (10500)